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ALASKA'S FISHERY RESOURCES

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Alaska's Fishery Resources

The Chum Salmon

By

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Alaska's Fishery Resources — The Chum Salmon

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ABSTRACT

The chum salmon, Oncorhynchus keta, is the most widely distributed and second most abundant of the five Pacific salmon. It is one of Alaska's valuable fishery resources. Chum salmon spawn in late summer and fall--some in small streams near the ocean and others in large rivers in which they travel as far as 1,500 miles from the ocean. The young hatch in midwinter but stay in the stream gravel until spring, when they emerge and migrate to sea. They spend 2 to 4 years in the sea and weigh about 10 pounds when they return to spawn and die in their native stream. Most chum salmon are taken in purse seines and are canned; hundreds of thousands are caught in gill nets and fish wheels for human and dog food. This fishery is mostly in the large rivers that run into the Bering and Chukchi Seas of northern Alaska. Little biological research has been done on chum salmon, so less is known about them than any other Pacific salmon.

INTRODUCTION

Chum salmon are one of Alaska's important fishery resources, although they are not as highly regarded as the other four Pacific salmon--pink, O. gorbuscha; sockeye, O. nerka; chinook, O. tshawytscha; and coho, O. kisutch. Chum salmon are more difficult to catch, are worth less per pound, and are less palatable than the other species. One of the reasons for the low appeal of canned chum salmon is the pale color of the meat.

The color of flesh and the appearance of chum salmon change as they approach maturity. While they are in the ocean, their flesh is rich red, but as they approach the spawning streams, it pales to a light pink. At this time they also lose their general silvery color, and vertical purple-black and dull red streaks begin to appear on their sides; as with many fish the color changes are more pronounced in the male than the female. The maturing male also develops a hooked jaw and enormously enlarged front teeth as he nears the spawning stream (fig. 1). These teeth are used to threaten and bite other males who come too close on the spawning ground. The hooked jaw is common to all five species of Pacific salmon and is the character that gave them the generic name Oncorhynchus, which means hooked snout.

GEOGRAPHIC DISTRIBUTION

Chum salmon are the most widely distributed of the five Pacific salmon species and the second most abundant. They occur in streams in North America along the North Pacific coast from Oregon to the Arctic Ocean coast of Alaska, and in Asia from the Arctic coast of Siberia to northern Japan. Scientists of the United States, Canada, and Japan, who work together through the International North Pacific Fisheries Commission, have shown by tagging experiments that Alaska chum salmon migrate throughout the North Pacific Ocean and Bering Sea and mingle in some areas with chum salmon from Asian streams. The Asian streams produce about four times as many chum salmon each year as the North American streams. The great Amur River of Siberia has the largest runs of any river in the world. In Alaska, chum salmon are most numerous in streams in the southeastern Panhandle, Cook Inlet, and the large Arctic tributaries of the Bering and Chukchi Seas.

Figure 1.--Male chum salmon at time of spawning.

LIFE HISTORY

Chum salmon are anadromous, i.e., they return to fresh water to spawn after spending most of their life in the sea. They spawn in gravelly riffles in a wide range of stream habitats--from the tidal flats of small streams to springs in the headwaters of large river systems that are hundreds of miles from the ocean. The longest known migration to a fresh-water spawning area is by Yukon River chum salmon, which swim over 1,500 miles upstream from the Bering Sea. Chum salmon bury their eggs in the gravel in the late summer or fall; like all other Pacific salmon, they die soon after spawning. The young, which are called "fry" until they are about 1-1/2 inches long, hatch in midwinter, emerge the following spring, and migrate directly to sea. They grow rapidly in the ocean, and after 2 to 4 years return to spawn in the stream where they were hatched. By September of their first summer, they are 6 to 9 inches long. When mature, most chum salmon are 3 to 5 years old, weigh 8 to 15 pounds, and are about 30 inches long; males are usually larger than females (fig. 2).

A resume of the life history of the chum salmon is shown in figure 3, and principal features of the life history are compared with those of the other Pacific salmon in table 1.

The female takes a more active part than the male in the spawning process. When she is ready to spawn, she turns on her side and digs a series of small depressions or pockets in the gravel by beating her tail on the stream bottom. The aggregate of these depressions is called a nest or redd. As each depression is dug, the female extrudes a few eggs, which are fertilized by milt extruded simultaneously by the male. The female immediately covers the fertilized eggs by digging slightly upstream, washing more gravel into the pocket. After all eggs

Figure 2.--Mature male (upper) and female (lower) chum salmon.

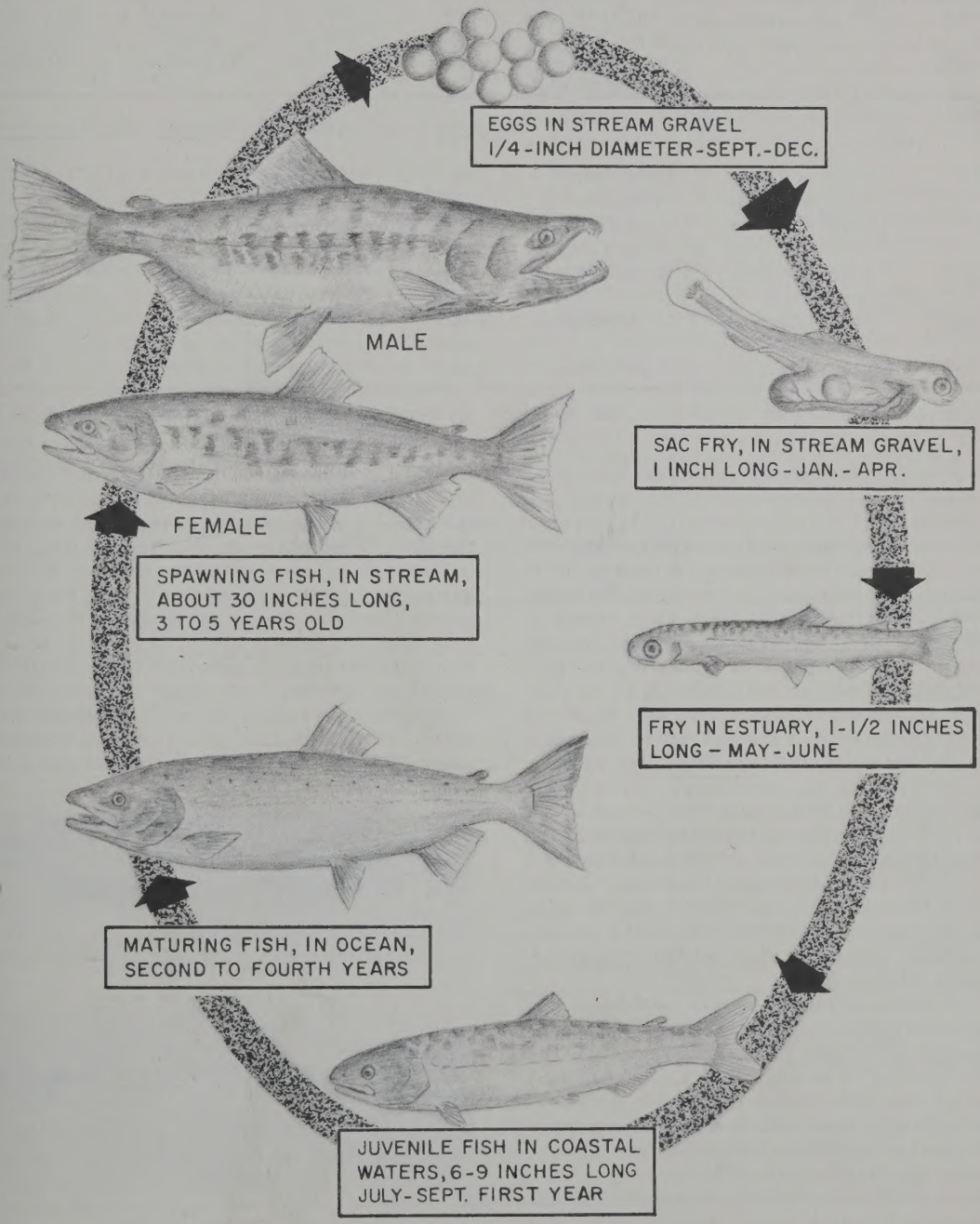

Figure 3.--Life cycle of chum salmon.

Table 1.--General life history features of the five species of Pacific salmon in Alaska. (Exceptions to these general descriptions occur frequently)

Species of salmon	Fresh-water habitat	Time spent in fresh water after emergence from gravel	Time spent at sea	Year of life at spawning	Average weight of adults[1]	Average eggs per female
			Years		Pounds	Thousands
Chum	Short and long streams	Less than 1 month	2-4	3-5	8	3.0
Pink	Short streams	Usually less than 1 day	1	2	4	2.0
Coho	Short streams and lakes	12-24 months	1-3	3-4	9	3.5
Sockeye	Short streams and lakes	12-36 months	1-4	3-6	6	3.5
Chinook	Large rivers	3-12 months	1-4	3-6	20	4.0

[1]Weight of whole or round fish. Source: Int. N. Pac. Fish. Comm., Bull. 12, p. 48.

are deposited, the female guards the site from other would-be spawners until she dies a few days later.

Female chum salmon produce many eggs, but relatively few survive to enter the ocean. Most of them disappear during spawning or die in the gravel during the winter. A female produces from 1,000 to 7,000 eggs in the fall, but the number of fry that hatch in the spring and migrate to the ocean is usually less than 10 percent of the number of eggs produced. Eggs and fry perish for many reasons: other spawning salmon (especially later spawning pink salmon) may accidentally dig up the eggs; low streamflows and warm weather may reduce the amount of oxygen in the water to less than that required by eggs; floods may wash out deposited eggs or cover them with thick layers of gravel; exceptionally low temperatures may freeze the eggs along the edges of the stream during the winter; or birds or other fish may eat the fry as they migrate downstream.

Eggs hatch during the winter, and the young salmon are nourished by the yolk of the egg until they emerge from the gravel in the spring. The time required for an egg to hatch depends on the temperature of the water; eggs hatch earlier in warm water. Laboratory experiments have shown that at a constant temperature of 50° F., salmon eggs hatch in about 50 days.

Chum salmon fry have a characteristic appearance--greenish back, silvery sides and belly, and a series of more or less prominent narrow dark blotches or parr marks on the sides. In the sea the parr marks fade rapidly and soon disappear. In the stream pink salmon fry are often found with the chum salmon, but the young fish are easily distinguished because the pink salmon have no parr marks (fig. 4).

The diet of chum salmon changes as they grow. Fry usually do not feed during their migration to salt water, although if the stream is long and they have a great distance to travel, they may eat small insects and other small organisms. During their first summer in the ocean, they eat small marine invertebrate animals such as barnacle nauplii, tunicate larvae, and copepods. As they grow larger and move

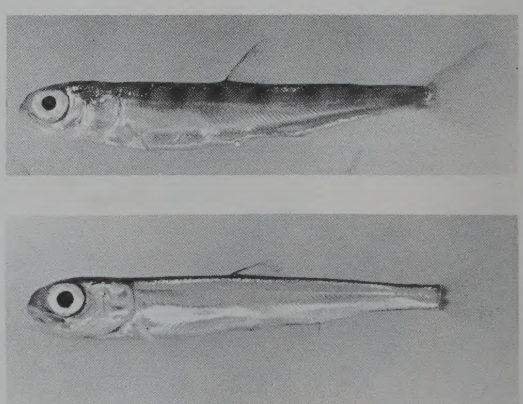

Figure 4.--Fry of chum salmon (upper) and pink salmon (lower). The two species often occur together but are easily distinguished by the parr marks on the chum salmon.

farther out into the open ocean, they feed on small fish, such as herring, or on larger invertebrates, especially euphausiids. Although mature chum salmon stop feeding when they return to the stream where they will spawn, the energy stored in the oils of their flesh sustains them through migration and spawning.

ECONOMIC IMPORTANCE

Fishermen get less money per pound for chum salmon than any other salmon; nonetheless chum salmon are important to Alaska's economy because of their abundance and wide distribution. Table 2 shows the number of fish, the fresh weight, the number of cases of cans, and the value of chum salmon caught in Alaska in 1959-68. The value represents the wholesale price of canned salmon at the time it is first sold. In addition to the canned salmon industry, a preserved-egg industry is developing rapidly. Chum salmon eggs are larger and brighter colored than those of other salmon and are therefore particularly desirable for caviar or fish bait. In 1968 the value of egg products from all species of salmon in Alaska was about $12 million; the value of canned chum salmon was $28 million. Most of the chum salmon for the canning and egg industries are caught in purse seines, although a few are taken in drift gill nets. The commercial fishing season varies in different sections of Alaska from year to year but generally is from July to October.

Chum salmon are more difficult to catch in purse seines than other salmon, and fishermen often credit them with superior intelligence. When a school is encircled with the seine the fish tend to sound or dive under the lead line before the net can be pursed. Also, because chum salmon are often caught at an advanced stage of maturity, the enlarged sharp teeth and hooked jaws of the males may catch in the webbing, and valuable fishing time is lost disentangling them.

In addition to the chum salmon caught for canning, hundreds of thousands are taken each year

Table 2.--Number of fish,[1] weight,[2] numbers of standard cases,[3] and wholesale value of canned product[4] for chum salmon in Alaska, 1959-68 (not including subsistence catches)

Year	Fish caught	Pounds	Cases	Wholesale value of canned product
	Millions	Millions	Thousands	Millions
1959	-	32	415	$ 8.5
1960	-	48	627	12.9
1961	6	46	515	12.5
1962	7	58	702	16.3
1963	4	36	433	8.6
1964	7	63	691	12.2
1965	3	29	301	6.3
1966	6	52	585	14.6
1967	4	32	339	9.1
1968	6	52	641	28.0
Average	6	45	525	$12.9

[1]Whole or round fish. Source: 1961 data--Alaska Dep. Fish Game, Statist. Leafl. 11, table 21; 1962-67 data--Alaska Dep. Fish Game, Statist. Leafl. 15, table 10; 1968 data--on file Bur. Commer. Fish. Statist. Off., Juneau, Alaska 99801.

[2]Whole or round fish. Source: 1959-67 data--Alaska Dep. Fish Game, Statist. Leafl. 15, table 20; 1968 data--on file Bur. Commer. Fish. Statist. Off., Juneau, Alaska 99801.

[3]A standard case contains 48 1-lb. cans. Data from Nat. Fish. Yearbook Issue, 1968, p. 110.

[4]Source: 1959-66 data--Pac. Fish., 64th Yearbook Number, 1967, p. 110; 1967 data--Alaska Dep. Fish Game, Statist. Leafl. 11, table 18; 1968 data--on file Bur. Commer. Fish. Statist. Off., Juneau, Alaska 99801.

for personal use by Alaska natives (Indians, Aleuts, and Eskimos) along the large rivers of the Bering and Chukchi Seas north of Bristol Bay. The importance of this personal-use catch is sometimes overlooked because the fish are not normally sold and therefore are not recorded in most tabulations of the catch. Set gill nets anchored in river eddies are the usual means of capturing these fish, but in the Yukon and Kuskokwim Rivers most of them are caught with fish wheels.

The natives preserve chum salmon for later use as human or dog food by drying it in the sun and wind on pole racks along the river banks (fig. 5). The entire carcass, including the head, is used, and thick portions are slashed to facilitate drying (fig. 6). The milt and the eggs are often dried also.

The recent rapid increase in the use of motorized toboggans for transportation by Arctic Alaska natives has made dog teams less common, and the need for large quantities of fish for dog food is diminishing.

The State of Alaska Department of Fish and Game regulates fishing for chum salmon to ensure that sufficient numbers of spawners escape to spawn and maintain production. To achieve this goal the agency uses information from research done by its own department and by the Bureau of Commercial Fisheries. The scientists work to solve such questions as: How many chum salmon will return to Alaska waters each year? What abundance of spawners is needed to produce the greatest number of fry migrating to the sea? What factors in the fresh-water and early marine life limit survival of eggs and fry? Why do the numbers of adult chum salmon vary widely from year to year? Research is providing some of the answers to these questions, but so far only a beginning has been made. Less is known about the biology of chum salmon than of any of the other Pacific salmon.

Figure 5.--Chum salmon drying on the bank of a river.

Figure 6.--Chum salmon which have been slashed to facilitate drying.

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